

(12) **UK Patent Application** (19) **GB** (11) **2 255 477** (13) **A**
(43) Date of A publication 04.11.1992

(21) Application No 9106027.7

(22) Date of filing 21.03.1991

(71) Applicant
Grey Cell Systems Ltd

(Incorporated in the United Kingdom)

**Fulton House, Fulton Road, Wembley,
Middx, HA9 0TF, United Kingdom**

(72) Inventors
**David Chao
Nick Hunn**

(74) Agent and/or Address for Service
**N Hunn
Grey Cell Systems Ltd, Fulton House,
Fulton Road, Wembley, Middx,
HA9 0TF, United Kingdom**

(51) INT CL⁵
H04L 29/06

(52) UK CL (Edition K)
H4P PPEC

(56) Documents cited
GB 2211006 A WO 86/03925 A1

(58) Field of search
**UK CL (Edition K) G4A AFGDC, H4P PPEC PPG
PPNC PPS
INT CL⁵ H04L 29/06**

(54) **Apparatus for the connection of computers and associated peripherals**

(57) A system for connecting a number of Personal Computers and their peripheral printers, modems, faxes, etc, while allowing any of the computers to send data to any of the peripherals uses individual nodes mounted externally on each unit. There is no need for an identifying address at any of the transmitters, yet all of the functions of parity checking and data interleaving are fully implemented. A special data protocol is incorporated, which provides for high speed data transfer, and permits multiple access to the network. It prevents dead time on the network whenever a peripheral cannot accept data, and shares network time when many computers are trying to transfer data simultaneously. When data is to be sent from any PC, an initial packet of control data is sent which identifies the peripheral node that is to receive the data and which has a unique bit set for each possible action – start a data transfer, stop a data transfer, send the next byte or send the previous byte.

BEST AVAILABLE COPY

GB 2 255 477 A

APPARATUS FOR THE CONNECTION OF COMPUTERS AND ASSOCIATED
PERIPHERALS

This invention relates to an improved method of connecting Personal Computers and peripherals, which may include printers, faxes, modems, tape streamers and other products, to allow simple directing of data flow between them without sacrificing speed.

Traditionally, the IBM compatible Personal Computer has been designed such that it is capable of supporting only one printer, and that printer is not accessible to other computers. Several solutions to this have been produced. These range from simple cable switches, to central boxes which poll each computer to determine which requires access to the printer, and then granting it sole right to that printer for the duration of the data transfer. At a more advanced level, networks and network-like units have been introduced, which intercept and add identity data to the information from a PC, so that the source and destination of the data can be recognised, allowing it to be directed to the correct peripheral. Such schemes add severe overheads to the available data rate, as considerable extra data is required to be transmitted. They also require that each transmitting node has a unique identifying address, which assumes a degree of technical expertise to install and set up the system. An added problem of such systems is that they often require hardware to be fitted internally to the Personal Computer, and involve a large amount of program code, which takes up valuable disc storage space.

The invention uses a novel data protocol to overcome many of these limitations, to provide a fast, secure method of data transfer, without the need to set a unique address for the transmitting node. One key aspect of the invention is to provide a unit which connects externally to each computer and peripheral. This removes the need for a user to disassemble their computer. Each of the peripherals has an address to identify it, but there is no identifying address for any of the transmitting (Computer) nodes. When data is to be sent from any PC, an initial packet of control data is sent, which identifies the peripheral node that is to receive the data. The structure of this packet is such that it can be rapidly decoded by the receiver. The destination address is stored within the external node on the computer, and can be changed by software within the computer. There is no need to intercept the data stream and add additional destination information. If the receiver is powered up and able to accept data, it will acknowledge this packet with a similar packet, and the data transfer can begin. From this point onwards, data only is sent, ensuring the maximum data transfer rate. Because the hardware defines this established link as unique, parity checking can be implemented to detect data corruption, without the risk of other transmitters responding.

An important aspect of the invention is the response of other transmitters. Each transmitter also reads the initial packet, and those which would direct output to the same peripheral set a flag to prevent transmission of data. In this manner, there can be no conflict in sending data, so the need for a unique transmitter identifying address is removed. At the end of a transmission, another special packet is sent, which will reset all of these flags.

The invention also incorporates several extensions of this principle to increase the utilisation of the network. In many cases, if a large file is sent to the printer, the printer buffer will become full, and the data transmission will have to cease until the printer has finished processing the data it has already received. In this circumstance, the network would be sitting idle. To prevent this, each receiver contains a buffer memory, which can receive data at high speed. If this becomes full, the receiver will use a special packet to signal this status to the transmitter, which will cease transmission. This packet will also be recognised by all transmitters which are set to transmit to a peripheral with a different address: these will then be able to start their own transmission, using the standard starting packet to signal the destination. When this transmission is over, the original receiver, if its memory is no longer full, can reestablish its initial data link, and continue with its transfer.

A further refinement of this aspect of the invention is to limit the amount of time in which any one transmitter can send data. After this time limit has been reached, a condition similar to the memory being full is simulated, forcing the transmission to stop. A short time is then allowed for any other transmitter to start to send data to its peripheral, which will also obey the time limit. If no other transmission is detected in this time slot, the original transmission will be resumed. This continual pausing and checking for other users is repeated, ensuring that no unit can "hog" the network, and providing a smooth interleaving of data from different transmitters, thus fully utilising the network.

All of these features are based on a unique operating protocol, which defines the format of information sent between units. Many proprietary and public protocols exist, but generally they exhibit considerable redundancy, and the need for sophisticated hardware to decode the signals which are present. The strength of the current invention is that it implements a simple, structured protocol, which permits simple decoding at the same time as providing a high speed, accurate data throughput.

The protocol defines a 14 bit packet, which comprises the following bits:

1. A start bit to indicate the beginning of the packet
2. A control bit to determine whether the packet contains data or control information
3. Four bits which may be the first four data bytes, or which individually indicate

- a) The start of, or restart of transmission
 - b) The end of, or a pause in transmission
 - c) Confirmation of data receipt and request for the next data
 - d) Request to resend the previous data due to detected corruption
4. Four bits which may be the remaining four data bytes, or the target address of the peripheral
 5. Two bytes which determine whether the packet originates from a transmitter or a receiver
 6. A parity bit, which is used to check for corruption
 7. A stop bit.

The novel aspect of this protocol is that when in use for a control message there is a unique bit set for each possible action - Start a data transfer, stop a data transfer, send the next byte or send the previous byte. This leads to simple decoding, with an increase in the speed of response and a reduction in the complexity of the hardware required.

CLAIMS

1. A data transfer system, consisting of individual nodes connected externally to peripherals and personal computers, which allows multiple Personal Computers and Peripherals to be connected together, and which can direct and transmit data to any of the connected peripheral nodes without the need for an identifying address on any of the Personal Computer transmitters.
2. A data transfer system as described in Claim 1, which allows for parity checking of individual transmitted bytes, and automatically retransmits individual bytes when errors are detected.
3. A data transfer system as described in Claim 1 and Claim 2, wherein the circumstance of the data memory at the receiver being full will suspend the first data link and permit another transmitter to begin data transfer to a second peripheral.
4. A data transfer system as described in Claims 1 and 2, wherein the network usage is monitored, and the time usage of any active transmitter is limited, allowing interleaving of data between a number of transmitters and peripherals.
5. A data transfer system as described in any of the preceding claims, employing a data transfer protocol in which one distinct bit of each control packet is used to identify the required network action.
6. A data transfer system as described in any of the above claims, where the destination address for the data is stored in the external hardware such that the data stream does not need to be intercepted or amended to signal its destination.

Patents Act 1977
Examiner's report to the Comptroller under
Section 17 (The Search Report)

- 5 -

Application number

6027.7

Relevant Technical fields

(i) UK CI (Edition K) H4P (PPEC, PPG, PPNC, PPS);
G4A (AFGDC)

(ii) Int CL (Edition 5) HOYL 29/06

Search Examiner

K WILLIAMS

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

9 JUNE 1992

Documents considered relevant following a search in respect of claims

1 TO 6

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2211006 A (STANDARD MICROSYSTEMS) see Figure 6	1 at least
A	WO 86/03925 A1 (MOTOROLA) see Figure 3	1 at least

SF2(p)

SJJ - c:\wp51\doc99\fil000360

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).

THIS PAGE BLANK (USPTO)